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# TORQUE LIMITING ASSEMBLY

## BACKGROUND OF THE INVENTION

1. Field of the Invention

**[0001]** The subject invention relates to a transmission and torque limiting assembly intended for use in transmitting rotation from a drive to a compressor.

2. Description of the Related Art

**[0002]** Various torque limiting devices exist in the art that are used in compressors to decouple compressor shafts from driven members such as gears or pulleys. Although they may be used with almost any type of compressor, such devices are often used in compressors lacking an electromagnetically activated device or other type of clutch to engage or disengage the compressor shaft from the driven member. Referred to as a "clutchless" compressor, this type of compressor has a shaft coupled to a driven member that is in turn coupled to the accessory belt system of an engine. When the engine crankshaft rotates, the belt system rotates, which also causes the driven member and shaft to rotate.

**[0003]** A torque limiting device typically engages both the driven member and the compressor shaft, and transmits the rotation of the driven member to the shaft. Should an unforeseen malfunction occur within the compressor to cause the rotating shaft to seize or "lock up" and resist rotating in the same direction as the driven member, the torque limiting device will disengage the shaft from the driven member. This permits the disengaged driven member to continue rotating, and keeps the shaft from generating and transmitting a damaging reactive force to the engine.

**[0004]** An example of a torque limiting device is disclosed in United States Patent No. 5,706,922 ("Bondioli"). The Bondioli device utilizes multiple components to accomplish the straightforward act of disengaging a pulley from a shaft. In particular, the pulley of the Bondioli device has recesses that cooperate with wedge-shaped sliders. Each slider engages one of several pairs of pads carried by the device. The pads are urged together by underlying springs. The slider engages the pair at the point at which the pads intersect. The slider also engages one of the recesses in the pulley, and pivots in response to a torque applied by the rotating pulley on the slider. This urges the slider against the intersecting edges of the pads, and causes the pads to separate. The underlying springs compress and move away from one another in response. The slider continues to press against the pads and springs until it has pivoted free from the recess on the pulley. Once all of the sliders disengage the recesses, the compressor shaft disengages the pulley.

**[0005]** The Bondioli device is complicated and does not work unless multiple parts simultaneously cooperate to ensure that the compressor shaft is quickly disengaged from the pulley. Because so many components are used, rotation must be transmitted from the pulley to the compressor shaft through several energy-expending, intermittent steps. Thus, the Bondioli device fails to provide an efficient, cost-effective way to disengage a compressor shaft from a pulley or other driven member.

## BRIEF SUMMARY OF THE INVENTION AND ADVANTAGES

**[0006]** The invention provides a transmission and torque limiting assembly for transmitting rotation from a drive to a compressor. The assembly includes a driven member for rotation by the drive about an axis. A drive member is disposed about and coaxial with the driven member. A mechanism transmits rotation from the driven member to the drive member and disengages the drive member from the driven member in response to a predetermined reactive force between the members. Cams are presented by the driven member, and spring arms extend resiliently and spirally from the drive member to distal ends. The arms engage the cams to transmit rotation from the driven member to the drive member. The arms also move resiliently and radially to allow the distal ends to spring past the cams in response to the predetermined reactive force.

**[0007]** Accordingly, the subject invention overcomes the limitations of the related art by providing a torque limiting assembly featuring a simplified mechanism that not only transmits rotation from a driven member to a drive member, but also disengages the drive member from the driven member to prevent inadvertent damage to the engine or other source providing power to the driven member. This is achieved by providing a unique drive member with integrally formed spring arms that selectively disengage complementary cams located on the driven member.

## BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

**[0008]** Other advantages of the present invention will be readily appreciated as the same becomes better understood by reference to the following

detailed description when considered in connection with the accompanying drawings wherein:

**[0009]** Figure 1 is a perspective view of a torque limiting assembly according to one embodiment of the present invention with the cam followers engaging the cams in a locked position;

**[0010]** Figure 2 is a side view of the torque limiting assembly shown in Figure 1;

**[0011]** Figure 3 is a cross-sectional view of the torque limiting assembly taken from Line 3--3 of Figure 2;

**[0012]** Figure 4 is a fragmentary side view of one of the spring arms and cam mechanisms moving out of the locked position; and

**[0013]** Figure 5 is a side view of the torque limiting assembly with the cam followers released from the cams.

## DETAILED DESCRIPTION OF THE INVENTION

**[0014]** Referring to the Figures, wherein like numerals indicate like or corresponding parts throughout the several views, a transmission and torque limiting assembly for transmitting rotation from a drive to a compressor is shown generally at **10**. The assembly **10** includes a driven member **12** for rotation by the drive about an axis **14** in the direction "$D_1$" shown. A drive member **16** is disposed about and coaxial with the driven member **12**. The driven member **12** is operatively connected to an engine or other suitable power source by a belt assembly (not shown).

**[0015]** The assembly **10** also includes a mechanism **18** for transmitting rotation from the driven member **12** to the drive member **16**. The mechanism **18** also disengages the drive member **16** from the driven member **12** in response to a predetermined reactive force component "$F_{Rx}$" between the members **12** and **16**. This is achieved through cams **20**, which are presented by the driven member **12**. Spring arms **22** extend resiliently and spirally from the drive member **12** to distal ends **24** for engaging the cams **20** to transmit rotation from the driven member **12** to the drive member **16**. Using the spring arm **22** shown in Figure 4 as a representative example, each spring arm **22** also resiliently moves radially in the direction "$D_2$" shown to allow the distal end **24** to spring past the cam **20** in response to the predetermined reactive force component "$F_{RX}$".

**[0016]** The distal ends **24** include cam followers **26** for engaging the cams **20** to transmit the rotation from the driven member **12** to the drive member **16**. As is shown in Figure 5, the cam followers **26** are released from the cams **20** in response to the predetermined reactive force component "$F_{Rx}$" as the spring arms **22** move resiliently. Each cam follower **26** includes a pivot **28** that pivotally connects the follower **26** to one of the distal ends **24**. Each pivot **28** has a recess **30** for receiving a selected one of the cams **20** to move the cam follower **26** out of a locked position such as that shown in Figure 1. The cams **20** include posts **32**. Each recess **30** is complementary to each post **32**.

**[0017]** Although any suitable device may be used, the driven member **12** is a pulley **34** with a planar face **35**. The pulley **34** also includes an outer surface **36** in which grooves **37** are formed for engaging a belt (not shown) to operatively

connect the pulley **34** to the engine or other power source. The posts **32** extend axially from the planar face **35**. A hub **38** is coaxially disposed within the pulley **34**. The spring arms **22** are integrally formed with the hub **38** and extend radially and spirally between the hub **38** and the posts **32**. This positions the cam followers **26** so that they can engage the posts **32**.

**[0018]** A stop pin **40** is carried by each of the cam followers **26**. The stop pin **40** reacts with the adjacent distal end **24** to limit pivotal movement of the cam follower **26** in one direction. This maintains each cam follower **26** in the locked position shown in Figure 1 to permit transmission of rotation from the driven member **12** to the drive member **16**. As is shown in Figures 4 and 5, this also allows pivotal movement of each cam follower **26** out of the locked position in response to the predetermined reactive force component "$F_{Rx}$".

**[0019]** Obviously, many modifications and variations of the present invention are possible in light of the above teachings. The foregoing description of the invention is provided for the purpose of illustration only and not for the purpose of limitation — the invention being defined by the claims.